Vol. 20 **INDEX** JANUARY, 1955 **ISSUE** No. 1

CORNELL-DUBILIER ELECTRIC CORP.
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To You . . . whom we think of as a friend and for whose pleasure and profit "The Capacitor" is dedicated, we sincerely wish a **New Year** of continued happiness and prosperity.

CORNELL-DUBILIER ELECTRIC CORPORATION.

ULTRA-HIGH RESISTANCE MEASUREMENTS

In the electrical laboratory, as well as in various types of field electrical work, the need often arises to measure resistance values in the upper-megohm ranges. Examples which come quickly to mind include insulation resistance, capacitor leakage, insulator surface leakage, leakage paths in electron tubes, moisture absorption determination, moisture-trace or electrolyte-trace content determination, appraisal of oils and other non-conducting fluids on the basis of dielectric resistance, and checking stray leakage paths in electrical equipment.

At one time, within the working life of many present electronic engineers, a single megohm was considered a very large amount of resistance and higher values were thought to be of little practical consequence in the radio equipment of the time. At present, however, it is commonplace to consider resistance values of the order of hundreds to thousands of megohms and to undertake their measurement.

As in other types of tests and measurements, various systems and instruments are available to the technician. The particular one chosen for a measurement of ultra-high resistance depends upon numerous factors such as availability of instrumentation, accuracy required, range of resistance desired, and skill of personnel making the tests.

It is of interest to survey the methods and apparatus commonly used in the measurement of very high resistance values.

The Megger

Before the advent of electronics as such, electrical engineers in industrial and power fields measured very high resistance values with the aid of the megger.

A megger is a portable instrument consisting essentially of a high-voltage d. c. power supply and a special type of direct-reading ohmmeter. The early megger and many present models of the conventional type employed a self-

CORRECTION

In the circuit diagram on Page 5 of the November, 1954, issue of "The Capacitor," the capacitor introduced into the circuit at 100 KC, should be shown as 750 uufd — not 75 uufd.

NOTE: We are informed that Western Electric Type 2C51 Twin-Triode is similar to and interchangeable with General Electric GL5670 and Raytheon CK5670.

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contained, hand-crank-driven magneto generator as the voltage source. Several modern versions of the instrument also employ self-contained a. c. - operated d. c. power supplies for voltage sources. While this latter type eliminates the cranking operation, the complete portability of the hand-operated model is lost.

Small-sized, portable, hand-cranked meggers permit resistance measurements up to about 1,000 megohms.

Current-Meter Method of Measurement

The simplest, and often most readily available method of resistance measurement is the d. c. voltmeter-ammeter method. A simplification is the em-

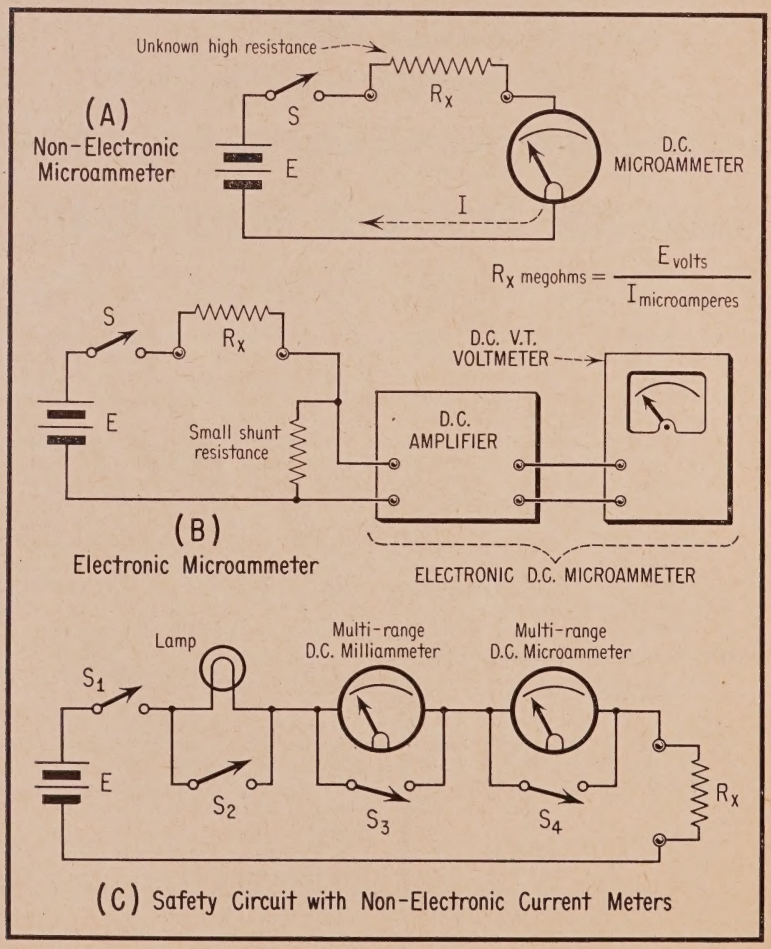


Fig. 1. Current-Meter Measurement Circuits.

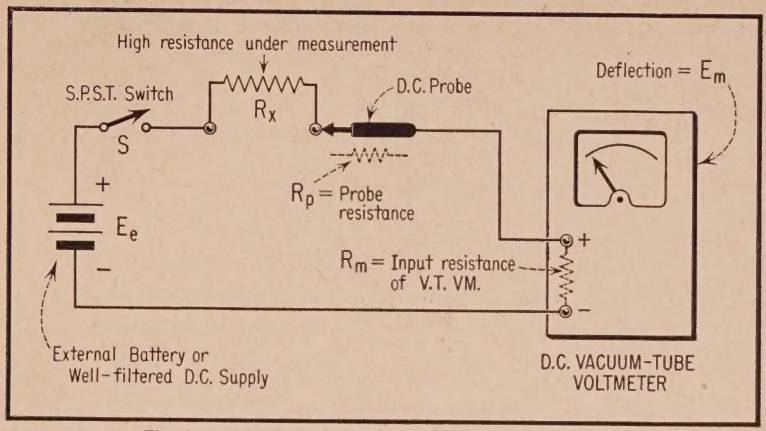


Fig. 2. Arrangement for High-Resistance Measurements with D.C. Vacuum-Tube Voltmeter.

ployment of a current meter alone when the voltage is stable and is known to a sufficient degree of accuracy to warrant omission of the voltmeter.

This applies also to the measurement of ultra-high resistances. A high d. c. voltage (E) may be applied to the unknown resistance (R_x), the resulting current (I) measured with a suitable microammeter, and the resistance value determined by means of Ohm's Law: $R_x = E/I$; where R_x is in megohms, E in volts, and I in microamperes. A convenient value of voltage is 500 v., this value having been standardized for insulation resistance measurements.

There is always some apprehension regarding the connection of a sensitive microammeter directly in series with a high voltage and unknown resistance in the manner shown in Figure 1(A). A short-circuit or flashover of the resistor easily might destroy the meter. Also, when insulation resistance of a capacitor is under measurement, the initial charging current of the capacitor can damage the meter. Nevertheless, this simple method of ultra-high resistance measurement can be found in use with some regularity throughout the industry. However, its use always is restricted to well-trained test personnel.

Whenever available, a vacuum-tube type of d. c. microammeter should be employed. Surges and large overloads do not damage this type of meter. Figure 1(B) shows the use of such an instrument. The small current flowing through the unknown high resistance (R_x) as a result of application of the high test voltage also flows through a small shunt resistance. This latter resistance is so low, with respect to R_x that its value can be neglected in the circuit. The voltage drop across this shunt is presented to a high-gain d. c. amplifier, and the output of the latter deflects a d. c. vacuum-tube voltmeter. The amplifier-voltmeter combination comprises an electronic d. c. microammeter. Vacuum tube microammeters, embodying the amplifier and voltmeter in a single unit, are available (e. g. RCA Type WV-84A) with full-scale deflections as low as 0.001 microampere. With a test voltage of 500 v., this deflection corresponds to 500,000 megohms.

Figure 1(C) shows a series circuit often employed for protection of a conventional non-electronic d. c. microammeter in ultra-high resistance measurements. In this arrangement, a filament-type lamp (115-volt rating), d. c. milliammeter, and d. c. microammeter

are connected in series with the unknown resistance (R_x) and the high-voltage supply. Initially, switches S_2, S_3, and S_4 are closed to short-circuit the meters and lamp. The meters are set to their highest ranges. Switch S_1 then is closed to apply voltage to the circuit. Switch S_2 next is opened. If there is excessive current through R_x, the lamp will glow and may burn out. If the lamp does not light, switch S_3 is opened to obtain a reading on the milliammeter scale. This meter then is switched to each successive lower range for accurate reading. If the current is seen by these readings not to exceed the limit of the microammeter, switch S_3 is closed and S_4 opened. The microammeter now will be deflected and may be switched successively to each lower range to obtain a more accurate reading. For highest accuracy, switch S_2 also may be closed to remove the lamp filament from the circuit.

Use of D. C. Vacuum Tube Voltmeter

Combination v. t. voltmeter - ohmmeters, in wide present use both in service shops and laboratories, have a variety of ohmmeter ranges. The highest of these ordinarily extends to 1,000 megohms.

The 1,000-megohm limit is sufficient for the usual run of leakage resistance measurements in electronic servicing, but is inadequate for some of the more demanding applications of research and development.

Figure 2 shows how the d. c. voltmeter section of the instrument may be employed in conjunction with an external battery (E_e) or well-filtered d. c. supply for ultra-high resistance measurements. The external voltage, E_e, can be up to 500 volts.

After the normal zero-setting operation is performed on the meter, the circuit is set up as shown in Figure 2. Switch S is closed to obtain a meter deflection, E_m. The unknown resistance $R_x = R_1 (E_e - E_m)/E_m$. Here; R_1 is the sum of probe resistance R_p (usually 1 megohm) and the input resistance of the v. t. voltmeter (usually 10 megohms), E_e is the external d. c. supply voltage, and E_m the meter deflection. Resistances R_x and R_1 may be expressed either in ohms or megohms, provided each is expressed in the same units.

As an example of the application of this method, consider that a supply voltage, E_e, of 250 v. is employed, the meter resistance ($R_p + R_m$) equals 11 megohms, and the v. t. voltmeter deflection is ¼ volt. The unknown resistance R_x then equals $11 (250 - 0.25) / 0.25 = 11 (249.75) / 0.25 = 2747 / 0.25 = 10{,}988$ megohms.

Laboratory-Type Commercial Megohmmeter

Figure 3(A) shows the basic arrangement of the modern, electronic megohmmeter. The unknown high resistance, R_x, is connected in series with a standard high resistance, R_s, and a d. c. voltage source, E. A d. c. vacuum-tube voltmeter shunts the standard resistor. This is seen to be the same general arrangement employed in conventional, low-range ohmmeters, except that a high-resistance-input d. c. vacuum-tube voltmeter is used as the indicator.

The supply voltage divides across R_s and R_x in proportion to the ratio of these two resistances. The voltage drop across R_s deflects the v. t. voltmeter and this deflection accordingly may be interpreted in terms of resistance units to give a direct-reading megohms scale for the meter. In order for the scale to be accurate, the total circuit resistance (d. c. supply-source resistance plus voltmeter input resistance) must be constant. Also, the supply voltage and the tube grid conductance in the voltmeter must be constant.

Commercial megohmmeters are made in both a. c. - operated and battery-operated types. Figure 3(B) shows the skeleton circuit of a commerical, laboratory - type megohmmeter (General Radio Type 1862-A) which provides a range extending from 0.5 megohm to 2 million megohms, a spread of 4 million to 1. This is a completely self-contained, a. c. - operated instrument.

The internal, stabilized power supply applies 500 volts d. c. to the unknown resistance under measurement. For maxi-

mum stability, a balanced d. c. vacuum-tube voltmeter circuit (embracing triodes V_1 and V_2) is employed. The input resistance of this circuit is very high, there being only the high-resistance standard multipliers in the grid circuit. Basic full-scale deflection of the v.t.v.m. is 2 volts.

High-Resistance Bridge

The standard 4-arm d. c. Wheatstone bridge, used for lower-resistance measurements in the laboratory, seldom is used for resistances much in excess of 1 megohm because of the high ratio and attendant inaccuracy of the ratio arms under these conditions. Another difficulty is the poor impedance match between the bridge circuit and any conventional low-resistance d. c. galvanometer at such high ratios.

The simple d. c. resistance bridge may be arranged, however, as shown in Figure 4, for measurements up to several thousand megohms. Here, a sensitive d. c. vacuum-tube voltmeter (preferably with arrangement for setting the pointer initially to center-scale zero)

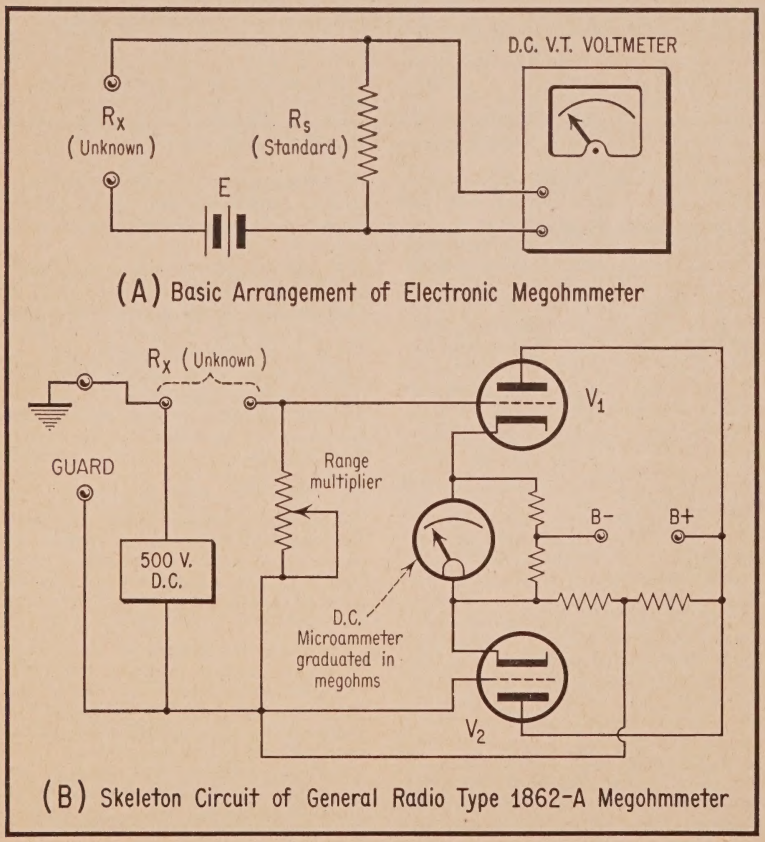


Fig. 3. Laboratory-Type Megohmmeter.

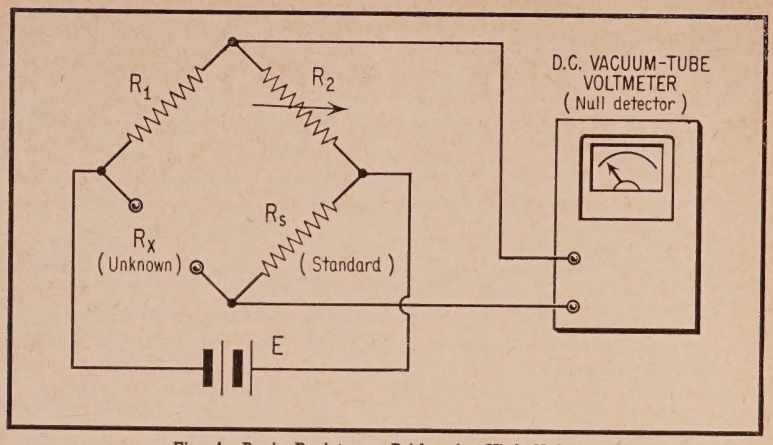


Fig. 4. Basic Resistance Bridge for High Values.

is employed as a high-resistance-input galvanometer (null detector). If high-resistance standards are used at R_s, and the ratio arms (R_1 and R_2) kept high in resistance to limit current through the bridge arms to a safe value, the bridge voltage (E) may be raised to 50 volts or more for increased sensitivity. The most sensitive, low-voltage scale of the v. t. voltmeter is employed. At null, the value of the unknown resistance $R_x = (R_sR_1)/R_2$.

When employing a modified bridge of this type for ultra-high resistance measurements, extraordinary precaution must be exercised to keep all circuit and instrument resistances high. This reduces error due to high-resistance leakage paths. The terminals for the resistance under test, for example, must have insulation resistance far in excess of any anticipated test-resistance value. It often is not sufficient to employ high-grade insulation for this purpose, but also to keep the terminals and the surrounding panel area always clean and dry. High-grade insulation coating sprays often are used. The instrument panel, likewise, must be kept clean and dry, and the wiring must be amply spaced to prevent circuit leakage paths.

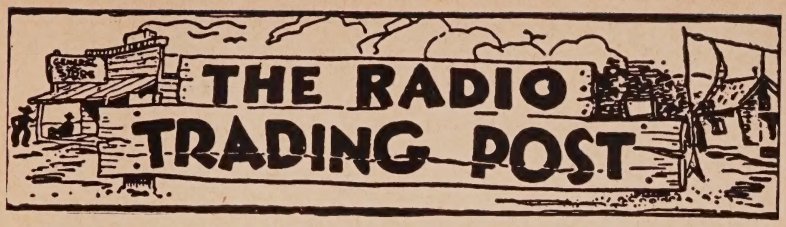
Bridges of this type have been set up with standard arms (R_s) consisting of high-megohm resistors. Research workers have reported measurements made as high as 1 million megohms with such equipment.

A representative commercial megohm bridge (General Radio Type 544-B) is a combination of Wheatstone bridge and d. c. vacuum-tube voltmeter. The Type 544-B instrument has a total range of 100,000 ohms to 1 million megohms. A. C. or battery-type supplies may be used for voltage. The a. c. type applies 500 volts to the unknown; the battery type 90 volts.

High-Resistance Standards

Specially fabricated and insulated high-range resistors are available for use as standards in megohmmeters, megohm bridges, and similar instruments and for standardizing ultra-high-resistance measuring instruments.

International Resistance Co. Type FH-1 resistors are supplied from 100 to 10,000 megohms for 500-volt service, and from 100 to 20,000 megohms for 1,000-volt service. Victoreen Instrument Co. Type 249 is supplied between 1 and 1 million megohms. Also available are Type 65X resistors manufactured by S. S. White Dental Mfg. Co., Industrial Division, to values as high as 10 million megohms.



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SWAP — 3 Hi-Fi amplifiers; 15" Hi-Fi spkr.; rec. tubes; snap action switches; relays; motors. for what have you? Thomas R. Rohland, R 3, Martinsville, Ind.

FOR SALE — Back issues QST, CQ and Short Wave Craft, 15 cents ea., postpaid. De Sousa's Radio Service, 45-A Joy St., Boston 14, Mass.

WANTED — Radio Operators License Q&A Manual, 4th ed.; Recording and Reproduction of Sound, A. Reed, 2nd ed.; Electronics—Principles and Applications, Ralph R. Wright. Rudolph Chlupsa, 45-56 189 St., Flushing 58, N. Y.

FOR SALE — To highest bidder: 7 coin-operated radios, 6-tube, one hour for quarter, FOB. Allen Floersheim, Box 56, Roy, N. M.

WANTED — Precision E-200-C, E-400, ES-500A and EV-10A. Will pay cash or trade Pentrone tape recorder, comm. rcvr., radio parts. E. A. McCall, 10004 E. 34th St., Kansas City 29, Mo.

FOR SALE — RCA test osc., model 167-B, 100 kc., to 30 meg., A-1 cond., $25; Jackson sig. gen., model 106, 100 kc. to 216 meg., $50. H. Bodnar, 911 Willoughby Ave., Brooklyn 21, N. Y.

EXCHANGE — Info regarding operation of TV in automobiles. Also want 3" TV in operating cond. State price. S. A. Cohen, Room 1033, Lemuel Shattuck Hospital, Nurses' and Personnel Bldg., 80 Morton St., Jamaica Plain, 30, Mass.

FOR SALE — Mallory "88" converters, Blonder-Tongue 99 UHF converters. Best offer. Bud's Radio & TV Service, 5912 Hampton Ave., St. Louis, Mo.

SELL OR TRADE — BC-929-A radar scope, complete with instructions, schematic for converting to test scope, $18 FOB, or will trade for Heath test equip. W. W. Ellett, 10111 Scenic Blvd., Cupertino, Calif.

FOR SALE — SXX-28 and SX-24 with matching speakers; Eico 320 sig. gen., factory built; Gardiner code machine and 10 tapes; 522 2-meter trans-power supply-mike, BC-654, BC-645 transceivers. A. Turturro, 146-26 N. Hempstead Tpke., Flushing 55, N. Y.

SELL OR SWAP — UHF convertors, Regency RC-600, $25; Regency RC-53, $10; RCA U2A, $12; Gonset 3-30, $25; Carter dynamotor, 6 v. input, 350 v. 200 mil. output, $25. Need E-200-C, Viking II, Harvey-Wells. Floyd Butters, Route 2, Peoria 5, Ill.

TRADE — 3" model 164E Dumont scope for commercial tilt arbor circular saw using 8 or 10" blade, good cond. John Bates, 58 W. Central Ave., Paoli, Pa.

TRADE — Racing homing pigeons for anything in ham radio, radio servicing. D. T. Willis, 1404 S. Jackson, Tucumcari, N. M.

WANTED — Complete up-to-date radio-TV course. Will consider older one if cheap. Wesley Kay, 666 W. Cordova, Vancouver, B. C.

SELL OR TRADE — Rectifier unit, perf. cond., 95-125 v. AC, 60 cy. input, 24-36 v. AC at 1.5 amps output, black crinkle case 12" x 8" x 6". Need 40 w. mod. transformer or what have you? F. E. Shanks, 2416 Ralston Lane, Redondo Beach, Calif.

FOR SALE — Elmac A54H; PS-2V for Elmac for AC operation. Best offer. E. Bowley, 31-19 43rd St., Long Island City 3, N. Y.

FOR SALE — Riders 10, 11, 12, $10 each, or 3 for $20, plus express. Modern Radio Labs, 328 Fuller St., Redwood City, Calif.

SWAP — Wireless Ultra-mic, two tubes AC, for RCA 45 record changer without amp. Galen Stutzman, 2741 Fairlawn Ave., Adrian, Mich.

FOR SALE — Sylvania Polymeter, 1. n., $45, plus freight. Ernest Bonem, 110 Egan Ct., Cincinnati 29, Ohio.

FOR SALE — Royal Air Force receiver, R1155, with power pack, loudspeaker. A. Glass, 9401 - 64 Rd., New York 74, N. Y.

WANTED — Riders radio vols. 5, 22, 23; Riders TV vols. 1, 2, 10-13; RCA Chanalyst and other RCA test equip.; Hickok tube tester. Vincent Baratta, 53-05 64th St., Maspeth, L. I., N. Y.

FOR SALE — RCA scope, model WO56A; Hickok tracer, model 155; Hickok 288X sig. gen.; Riders radio vols. 1 to 22. Blanche Morris, Route 2, Box 546, Atascadero, Calif.

FOR SALE — Hallicrafters SX28 rcvr. with bass reflex speaker in excellent cond.; Gonset 3-30 mcs. mobile converter with noise clipper and steering post mount, A-1 cond., instructions. Troy Spencer, Bassett, Va.

FOR SALE — Riders TV manuals 1 to 11, never used, year old. $150, plus freight. Laurence Bertoldo, 926 Cunningham St., Rockford, Ill.

FOR SALE — Radio City tube tester, model 322, 8 years old, nine pin test socket, picture tube test adapter, $15; Eico voltmeter, model 102, $12; sig. gen., model 320, $23. Wm. R. Holleran, 5515 Ollie St., Pittsburgh 7, Pa.

SELL OR SWAP — Weston sensitrol relay and photo cell; BC-645, BC-454; Marker-Beacon rcvr.; relays and surplus radio parts. M. Youngman, 515 South Blvd., Oak Park, Ill.

WANTED — Marine rcvr., prefer Federal or RMCA, must cover 160 kc. will pay cash or trade 16" Meck TV-Radio comb. Cecil Chafin, 1862 McConnell Dr., Decatur, Ga.

TRADE — RCA 30 w. Carfone 152-174 mc. Rec/Trans. complete with all accessories. (6 volt) want 110/60 cy. power plant, rifles, shotguns, Police 110 v. rec. movie camera and (8mm. or 16mm sound) projector. Oaklane Electric Co., Box 439, Sicklerville, N. J.

FOR SALE — Meissner Analyst, complete in perfect cond., $45; Philco Tube Tester, tests all tubes, $40. W. W. Marsh, 219 Girard Ave. No., Minneapolis 5, Minn.

SELL or SWAP — Commercially made 20 w. PA Amplifier; 4 separate inputs; Built-in Electronic Mixer with separate controls for each input; bass and treble boost. Want good VTVM, Preselector (RME), or VFO. Richard M. Kayne, 233 Naples Terrace, Bronx 63, N. Y.

FOR SALE — Radio and TV Test Equip., very reasonable. H. Latko, 1922 Dickens, Chicago, Ill.

WANTED — 21EP4A pix tube, 3-speed record changer, Belmont Boulevard pocket radio, or other hearing-aid types, Standard Coil Cascode Tuner, Tape recorder. Oliver A. Zucco, Granite Ave. Ext., Canaan, Conn.

TRADE — Model SX-25 rcvr. with matching spkr. in perf. cond. for 8mm. projector or AM—FM tuner or tape recorder. Local only. Marstan TV Co., 13 Marcy Pl., Bronx, N. Y.

TRADE — Antique radio tubes type 401 and UV 199. Will trade for binoculars or what have you? Bill Green, 38 Gautier Ave., Jersey City, N. J.

FOR SALE — Blocking oscillator pulse transformers at low cost. C. E. Tschiegg, 2307 Evans Dr., Silver Spring, Md.

WANTED — Hallicrafters SX-25. State cond. and price. Richard Holzman, 7076 Hyde Ave., Detroit 11, Mich.

TRADE — Movie Mite 16mm sound & silent projector for tape recorder. R. Gallitelli, 296-W. Main St., Patchogue, L. I., N. Y.

FOR SALE — 3 Regency, 1 Mallory, 2 Sutton UHF converters in factory cartons, like new, sell less than cost, $50. Blevins Radio, Charlestown, Ind.

FOR SALE — Sacrifice HQ 129X, 5" scope, VTVM, Freq. meter 221-AH, Sams Photofacts, QST's, Underwood model 5 typewriter, tubes. J. Pellock, 715 N. 7th, Benld, Ill.

SELL OR TRADE — 16" TV set, record changer. Fred Simonian, 96 Blossom St., Lynn, Mass.

WANTED — RCA "45" changer, state cond. and price. Paul F. Bahr, 1013 Indiana Street SE, Albuquerque, N. M.

FOR SALE — Hallicrafters S-40B in good cond. Best offer over $45. Theodore Fine, 3139 Godwin Terr., New York 63, N. Y.

SWAP — Inverter 110 DC to 110 AC 250 w.; Sperty walky-talky (2 meters), BC654 Strobe unit, 522 rcvr. with power supply; for antenna rotor units, beams, recording galvanometer, recording tape, 16mm films, ham or photo gear. L. Meister, 5 Highfield Lane, Nutley, N. J.

WANTED — 2000-3000 w. portable gasoline generator with 115 v. AC output. State make, model, cond., and price. Cash or trade. S. Consalvo, 4905 Roanne Drive, Washington 21, D. C.

FOR SALE — RCA 3" oscilloscope model 155A, good cond., with instruction manual, $22.50. David Pollock, 178 Pinckney Road, Little Silver, N. J.

FOR SALE — 30 w. deluxe built novice Xmtr. for 40 and 80 meters. 6AG7 VR regulated xtal. osc. and 6L6 final. Exc. cond. Complete with built-in power supply, $20. M. L. Scarff, 3312 Avenue G, Fort Madison, Iowa.

FOR SALE — Clough-Brengle type 82 oscillator sig. gen., $17. Paul Blum, 366 Hunterdon St., Newark, N. J.

WANTED — Hickok VTVM and capacitance tester model 209-A. Must be in good cond. P. M. Electronics, Box 101, Passaic, N. J.

WANTED — Good FM radio, recording tape, complete Hi-Fi system, wide-angle lens for 4x5 camera. J. T. Wentworth, R. 9, Box 467B, Springhill, Ala.

FOR SALE — 400 output trans. 300-1/2 inch stack 5,000 to 3 ohm impedance; 100 assorted, l. n. $60 for lot or best offer. J. E. Scaruffi, 3321 North Karlov Ave., Chicago 41, Ill.

FOR SALE — Manuals on aircraft maintenance, also NRI booklets. Complete list on request. Louis Porsetsky, 137-16-169 St., Jamaica 34, N. Y.

FOR SALE — Alliance antenna rotor with indicator, A-1 cond., $10; Dumont voltage calibrator 264, $7, with instructions — complete $8. Ted Wasek, 106 Beech St., Rutherford, N. J.

WANTED — Te-Craft 2-meter converter; 7DP4 CR tube; Measurements Model 59 Oscillator; two 815 tubes; Millen Grid Dip Meter; Communication rcvr; Riders vols. 15 and up. A. C. Livingstone, 12-01 Ellis Avenue, Fair Lawn, N. J.

FOR SALE — Long wave, AC RME LF-90 converter, 90 kc. to 60 kc., exc. cond., $21 postpaid. Charles W. Leigh, 162 Passaic St., Trenton 8, N. J.

FOR SALE — BC-348 converted to 110 v. AC, with power supply, power amplifier, Gonset Noise Limiter. Manuals and schematics. Cheap. New York only. Mort Rosen, 1530 East 27 St., Brooklyn 29, N. Y.

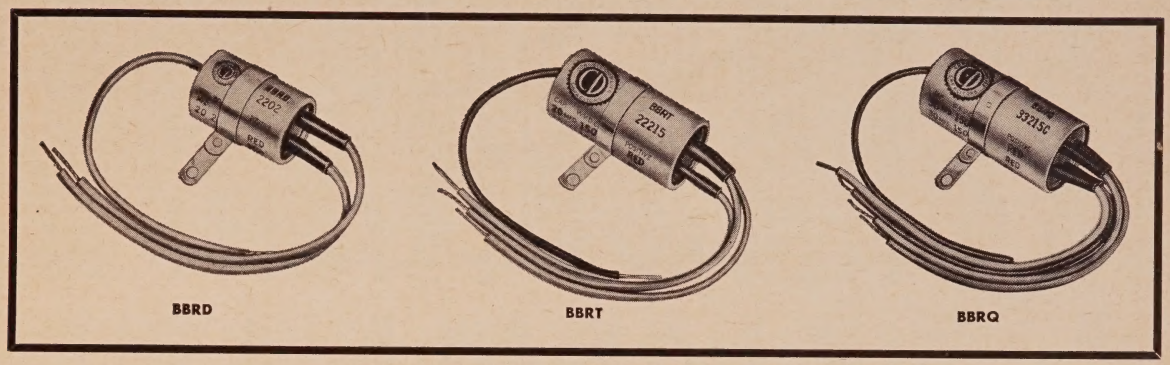
FOR SALE — RCP VOM Multitester model 442. Exc. cond., $8 COD; model SG43 RF sig. gen. 100 kc. to 90 mc., $7 COD. Victor Kozma, 3104 Wilkinson Ave., New York 65, N. Y.

FOR SALE — All Heath: SG-7 sig. gen.; V-6 VTVM; T-3 signal tracer, $50, little used, exc. cond. Dennis O. Marote, 51 Sherman St., New Bedford, Mass.

FOR SALE — Elmac Moblie rcvr. with 6 v. power supply. Robert E. Becker, 200 So. William St., Westmont, Ill.

FOR SALE — Hickok 530 Tube tester rebuilt by factory, good cond., $25 plus exp. Quitting business, large stock, write for what you need cheap. Glenn West, Box 608, Portland, Ind.

MULTI-SECTION TUBULAR ELECTROLYTICS



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Featuring—

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- New high-insulation vinylite covered leads — generous 7 inches long.
- Sections sealed in aluminum tube for protection against moisture getting in, or electrolyte drying out.
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- **IDEAL FOR OPERATION AT TEMPERATURES UP TO 85°C.**

BBRD—Dual Common Negative

BBRD Cat. No.	Cap. Mfd.	D.C. W. Volts	Can Size†—Ins. Dia. x Lgth.	List Price	Net Price
BBRD 2202	20–20	25	¾ x 1 7/16	$1.40	$ .84
BBRD 115	10–10	50	¾ x 1 7/16	1.40	.84
BBRD 2115	20–10	150	¾ x 1 7/16	1.55	.93
BBRD 2215	20–20	150	¾ x 1 11/16	1.65	.99
BBRD 3215	30–20	150	⅞ x 1 11/16	1.70	1.02
BBRD 3315	30–30	150	⅞ x 1 11/16	1.80	1.08
BBRD 4215	40–20	150	⅞ x 1 11/16	1.75	1.05
BBRD 4315	40–30	150	⅞ x 2	1.80	1.08
BBRD 4415	40–40	150	⅞ x 2	1.85	1.11
BBRD 5315	50–30	150	⅞ x 2	1.95	1.17
BBRD 5515	50–50	150	1 x 2	2.10	1.26
BBRD 8415	80–40	150	1 x 2 3/16	2.25	1.35
*BBRD 101015	100–100	150	1 x 3	3.20	1.92
BBRD 8D25	8–8	250	¾ x 1 7/16	1.60	.96
BBRD 16825	16–8	250	¾ x 2	1.70	1.02
BBRD 16D25	16–16	250	⅞ x 2	1.80	1.08
BBRD 2225	20–20	250	1 x 1 11/16	1.85	1.11
BBRD 3325	30–30	250	1 x 2 3/16	2.25	1.35
*BBRD 7V225	75–20	250	1 x 3	2.60	1.56
BBRD 8D45	8–8	450	⅞ x 1 11/16	1.70	1.02
BBRD 16845	16–8	450	1 x 2 3/16	2.00	1.20
BBRD 16D45	16–16	450	1 x 2½	2.25	1.35
*BBRD 2245	20–20	450	1 x 3	2.50	1.50
*BBRD 3345	30–30	450	1⅛ x 3 9/16	3.00	1.80
*BBRD 4445	40–40	450	1 x 4 1/16	3.40	2.04

BBRT—Triple-Common Negative

BBRT Cat. No.	Cap. Mfd.	D.C. W. Volts	Can† Size—Inches Dia. x Lgth.	List Price	Net Price
BBRT 22215	20–20–20	150	⅞ x 1 11/16	$2.20	$1.32
BBRT 32V215	30–25–20	150	⅞ x 2	2.25	1.35
BBRT 33315	30–30–30	150	1 x 2	2.35	1.41
BBRT 42215	40–20–20	150	1 x 1 11/16	2.25	1.35
BBRT 43215	40–30–20	150	1 x 2	2.35	1.41
BBRT 44215	40–40–20	150	1 x 2	2.35	1.41
BBRT 44415	40–40–40	150	1 x 2 3/16	2.45	1.47
*BBRT 84215	80–40–20	150	1 x 3	2.75	1.65
BBRT 2215C	20–20, 20	150, 25	⅞ x 1 11/16	2.05	1.23
BBRT 3315C	30–30, 20	150, 25	⅞ x 2	2.20	1.32
BBRT 4215C	40–20, 20	150, 25	1 x 1 11/16	2.15	1.29
BBRT 4315C	40–30, 20	150, 25	1 x 1 11/16	2.20	1.32

BBRT—Triple-Common Negative

BBRT Cat. No.	Cap. Mfd.	D.C. W. Volts	Can† Size—Inches Dia. x Lgth.	List Price	Net Price
BBRT 4415C	40–40, 20	150, 25	1 x 1 11/16	2.25	1.35
BBRT 4415X25	40–40, 250	150, 10	1 x 2 3/16	2.60	1.56
BBRT 5315C	50–30, 20	150, 25	1 x 1 11/16	2.35	1.41
BBRT 5515C	50–50, 20	150, 25	1 x 2 3/16	2.50	1.50
BBRT 8415C	80–40, 20	150, 25	1 x 2½	2.65	1.59
BBRT 3215C10	30–20, 100	150, 25	1 x 2	2.35	1.41
BBRT 5315X20	50–30, 200	150, 10	1 x 2 3/16	2.55	1.53
BBRT 5315C10	50–30, 100	150, 25	1 x 2 3/16	2.45	1.47
*BBRT 5315C25	50–30, 250	150, 25	1 x 3	3.10	1.86
BBRT 8215C10	80–20, 100	150, 25	1 x 2½	2.75	1.65
BBRT 2225C	20–20, 20	250, 25	1 x 2	2.25	1.35
BBRT 4225C	40–20, 20	250, 25	1 x 2 3/16	2.55	1.53
BBRT 4425C	40–40, 20	250, 25	1 x 2 11/16	2.90	1.74
*BBRT 7V4125	75–40–10	250	1⅛ x 3	3.45	2.07
*BBRT 16T45	16–16–16	450	1⅛ x 3	3.10	1.86
*BBRT 2245C	20–20, 20	450, 25	1 x 3	2.90	1.74

BBRQ—Quadruple-Common Negative

BBRQ Cat. No	Cap. Mfd.	D.C. W. Volts	Can† Size—Inches Dia. x Lgth.	List Price	Net Price
BBRQ 33215C	30–30–20, 20	150, 25	1 x 2	$2.90	$1.74
BBRQ 42215C	40–20–20, 20	150, 25	1 x 2	2.85	1.71
BBRQ 53215C	50–30–20, 20	150, 25	1 x 2½	3.05	1.83
BBRQ 44315C	40–40–30, 20	150, 25	1 x 2½	3.00	1.80
*BBRQ 55515C	50–50–50, 20	150, 25	1 x 3	3.45	2.07
*BBRQ 22245C	20–20–20, 20	450, 25	1⅛ x 3 5/16	4.05	2.43

EDL—Dual Separate Section

Type EDL Capacitors are dual units in cardboard tube containers with wax-filled ends. Capacities, voltages and polarity of the leads are clearly defined by color coding stamped on the tube casing.

TEMPERATURE RANGE: to +65°C.

EDL Cat. No.	Cap. Mfd.	D.C. W. Volts	OVERALL Size—Inches Dia. x Lgth.	List Price	Net Price
*EDL 2215SS	20–20	150	15/16 x 2⅝	$1.65	$ .99
*EDL 3315SS	30–30	150	1 x 2⅝	1.80	1.08
*EDL 4215SS	40–20	150	1 x 2⅝	1.75	1.05
*EDL 4415SS	40–40	150	1 1/16 x 2⅞	1.85	1.11
*EDL 5315SS	50–30	150	1 1/16 x 2⅞	1.95	1.17
*EDL 5515SS	50–50	150	1⅛ x 3⅛	2.10	1.26
*EDL 8415SS	80–40	150	1 3/16 x 3⅜	2.25	1.35

†For OVERALL size on BBRD, BBRT and BBRQ, add 1/16" to Diam. and 3/16" to Length.
All above Packed—5 Units per Carton, except those marked (*) which are individual Carton Packed.

SELL OR TRADE — Philco test oscillator to 30 mc., battery operated; Tobe capacitor analyzer; 10" GE console TV-Radio, exc. cond. Need audio oscillator, VTVM factory wired, tape recorder. A. Salesberg, 438 Saratoga Ave., Brooklyn, N. Y.

FOR SALE — Espey 511B 14 tube AM-FM Tuner and preamp., W2 Williamson amp. Seeburg record changer, $125 complete. C. T. Martowicz, 83 East 7 St., New York City, N. Y.

WANTED — HT-4 Xmtr. to buy, or trade for V-70D, RLS coils and swinging link assem., Bud 80 mmf. dual cond. T-55, Simpson model 27 0-150 MA. 3-Gordon handwheels. Sell separately. PYRYT, 322 Ross Rd., Paramus, N. J.

TRADE — Complete 25 w. sound system for good 12" TV, will swap Transivision Field strength meter for Fly back and Yoke tester. John Arnold, Box 84, Bluffs, Ill.

FOR SALE — Blonder-Tongue UHF converter model 99, $12; Webster-Electric Ekotape model 109, $60; Grommes custom 205 pre-amp & 110 basic amp, $50; Astatic TV, VHF Booster, $9. R. Russel, 610 Walton St., Lemoyne, Pa.

SELL or TRADE — 650 How-To-Do-It books, Popular Science, Popular Mechanics, etc. $8, or radio equipment & parts. Ralph Miller, 122 Intervale St., Roxbury 21, Mass.

SWAP — Precision Series 40 AC-DC VOM and Beede 0-1 DC milliampere meter, 50 ohms int. resistance, 2" round for Signal Tracer. Both perf. cond. Joseph Janata, 2510 21st St., Astoria, L. I. C. 2, N. Y.

FOR SALE — NRI Advanced Radio and Communication Course, complete with experiments and parts. Includes multitester, Xmitter and power supply, $100. A. Cuomo, 1009 Adee Ave., Bronx 69, N. Y.

SELL OR TRADE — 20,000 ohms/v. meter; Webcor wire recorder (needs work); 3200 v. Plate Xformer. Los Angeles. R. Fleischer, 2642 Bentley Ave., Los Angeles 64, Calif.

FOR SALE — Hickok sig. gen. 1. n.; 40 1. n. tubes; RF-IF coils, Riders 1-11; TV Schematics. All to highest offer. Frank Beckman, 2442 76th Ave., Oakland 5, Calif.

WANTED — 6 v. rotary converter, output 115 v. AC or DC min. 40 w. E. W. Smith, 365 30th St., San Francisco, Calif.

SWAP — Eico L/C/R bridge; RCA battery operated voltohmyst; Philco FM-AM sig. gen.; Edwards FM tuner; 6AK5 tubes; Chevy radio 49/50; phono converter 115 DC to 115 AC, for what have you? E. Duggan, 1013 Putnam Ave., Brooklyn, N. Y.

SELL OR TRADE — Clean copies QST Dec. 1930 thru 1953. E. L. Butcher, 920 Olive Ave., Hebron, Neb.

TRADE — NRI Radio-TV servicing course, 65 lessons, less kits, for 10" or 12" TV in working cond.; Eico sig. gen. in good cond.; or Heath or Eico VTVM. Emil J. White, RD 1 Box 96C, England, Ark.

SELL OR TRADE — RCP model 663 VTVM and capacity meter, $25; TU10B tuning unit, $3; U. S. C. G. TC-128 mobile Xmitter, 10 w., needs work, $20; Waller T-150 aircraft Xmitter, $30; Want 8mm. movie camera, 12 v. mobile Xmitter. A. Kimeldorf, 936 Chancellor Ave., Irvington 11, N. J.

FOR SALE — Model 425 Eico scope $35; Supreme model 564, 5" scope, $90, both little used, prefer local. Fred E. Saron, 844 E. 13th St., Brooklyn 30, N. Y.

SELL OR TRADE—Regency UHF converter, 1. n., $12.50 FOB; Mallory UHF converter, $17.50 FOB. Will consider trade. M. E. Radio & TV, Box 6042 ESS, Flint 6, Mich.

FOR SALE — Hewlett-Packard 330B Distortion Analyzer $200; H/P Audio Oscillator 201B, 1. n., $75 FOB. M. T. McKee, Box 307, Mt. Clemens, Mich.

FOR SALE — 2 Robinson 16" solid aluminum, xcription tone arms; West. Elec. Hi-Fi grid to 50, 250, 500 ohm xformer; Telex unit, 1. n., for recording telephone conversation. R. N. Brunt, 61 South Spring St., Elizabeth 4, N. J.

SELL OR SWAP — Superior sig. gen. model 1230, air compressors (1 and 2 cylinders), radio books and magazines. Want small outboard engine. Schneider, 9409 Ave. A, Brooklyn 36, N. Y.

SELL OR TRADE — Radio Engineering course, $5; Radio Troubleshooters Handbook, $2; Modern Radio Servicing, $2; Coyne's Applied Practical Radio Vol. 1 to 5, $5. Want 16mm film. Horace O. Pease, 144 Manson Ave., Kittery, Me.

WANT — Technical books and manuals, test equipment. Will buy or swap. Jos Cooper, 46 Rockwell Ave., Long Branch, N. J.

SELL OR SWAP — Approx. 225 standard brand radio tubes in original boxes, about half are odd or older types, $100 for lot. Need TV sweep generator. V. D. Walker, 716 North St., Pittsfield, Mass.

FOR SALE — Like new: Jackson 640 sig. gen.; Philco 7030 dynamic tester; RCA 7" scope model WO56A; RCA Master Voltohmyst WV87A with high voltage probe; Sprague Telomike; Battery Eliminator Electrox Ar-1 with ampmeter. H. Severance, Scottsville, N. Y.

FOR SALE — Factory wired Eico VTVM, model 221, $20. J. W. Minsky, 729 W. 186th St., New York 33, N. Y.

FOR SALE — Riders manuals (1 to 5 abridged) to 14, $50; Sams photofacts with binders thru 150, all in good cond., two additional binders with 11 assorted photofacts, all $150. Nicholas Bodreise, 735 E. 182nd St., Bronx 57, N. Y.

FOR SALE — Hallicrafters S38C, exc. cond. in original carton, $35. Howard Fox, 28 Browning Ave., Dorchester 24, Mass.

WANTED — Tape recorder 3-speed record player. Send for list of trades. Chas. Wendell, 19 Donald St., Bloomfield, N. J.

WANTED — Precision sig. gen. Series E-200C. Must be perfect. Will pay cash. L. Greenblatt, 144-40 77th Rd., Flushing 67, N. Y.

TRADE — Radio-TV tubes & parts for sig. gen. for AM alignment; AM-FM radio; 3-way portable radio; model 700 light and TV clock Regency voltage booster. Charles' Radio & TV Shop, Maple Ave., Box 87, Hebron, Ohio.

FOR SALE — NC120 communications rcvr., 550 Kc. to 30 Mc., 2 RF, 2 IF stages, Xtal filter, noise limiter, 500 v. output Xformer, and small speaker, $75. Herman Lukoff, 909 Glenview St., Philadelphia 11, Pa.

SELL OR TRADE — Mascode automatic, 3-tube TV booster, 2 all-channel Bow-Tie Reflector, UHF antennas. Want Oakridge 103 sig. gen. or 104 Syncro-Sweep gen., good cond., with instructions. Kenneth Guthrie, 316 E. 21st St. South, Newton, Iowa.

POSITION WANTED — In Radio or TV broadcasting or as Transmitter Operator, taking CREI courses. Graduate Radio & TV School 1st phone FCC license. Peter Cap, 233 Cook Ave., Yonkers, N. Y.

SELL OR SWAP — Tape recorder, used little, complete $90; Clark 25 w. amplifier, $30 or trade for test equipment. Details on request. Paul Bateman, 214 Sanneman Dr., Topeka, Kan.

FOR SALE — Cardwell VHF oscillator kits, l. n., with resistors and coils for ham bands 144-148 Mc., 220-225 Mc., and 420-450 Mc. Schematics included, $12 each, COD. Stanley Plasky, Jr., 160 Dean Dr., New Britain, Conn.

FOR SALE — RCA Rider chanalyst (162-C) inst. book and all cables, good cond., $75. L. Matushefske, 2 Elmont Road, Elmont, L. I.

WANTED — Riders Vol. 15 and 16 and odd copies of Sams Photofact folders. John C. Baxter, 1122 N. Geyer Rd., Kirkwood 22, Mo.

WANTED — RCA AVR20A rcvr. State cond. and price. James W. Dates, RD. 1 Caton Rd., Corning, N. Y.

FOR SALE — Heathkit Audio Oscillator AO-1, wired $15; C-D capacitor tester BN Bridge, $12.50. Both l. n., complete with original instructions. H. M. Lester, 101 Park Ave., New York 17, N. Y.

WANTED — Printing press 6x10 or smaller Di-Arco No. 1A bender. Have SCR522 Xmitter and rcvr., BC457-8-9 Xmitters, 2000 v. power supply. John Kozma, 17B Anna St., Fords, N. J.

WANTED — Will pay cash for Variacs & RCA TV Marker gen. Sell Supreme Audolyzer 562, $65; Philco Junior scope 7019, $22.50; Ferret 701 sig. gen., $30; Heathkit TS-2, $25. A. Allen, 3353 W. Irving Park, Chicago 18, Ill.

WANTED — Late model sig. gen., like Precision E-200C or Hickok for TV frequencies. Describe age, cond., price. Philip P. Goldstein, 1162 East 8th St., Brooklyn 30, N. Y.

FOR SALE — Like new GE: RPX40 phono cartridge, $3; Dia. Stylus RPJ 004, $10; Dia Stylus RPJ 002, $10; Webster Xtal. turnover cart., $3. Wholesale value, $40, sell all for $20. Royce Heintz, 3500 Woodmoor Rd., Baltimore 7, Md.

FOR SALE — Over 300 issues, in A-1 cond.: Popular Science, Popular Mechanics, Mechanic Illustrated, CQ, Radio Electronics, Radio News. Date back to 1943. Each 10 cents or library $25. John Griffin, 713 Vogel, East St. Louis, Ill.

TRADE OR SELL — Mallory TV-101 UHF converter, Regency RC600 converter, both l. n. G. E. Stowers, 2020 E. 48th Terr., Kansas City, Kan.

WANTED — Movie camera and/or projector, 8 mm., swap for ham, surplus or mobile gear. State other needs. George M. Underberger, 6213 Alonzo Avenue, Reseda, Calif.

FOR SALE — Slightly used model 610A Hickok TV and FM sweep gen., with marker. Also 680 RF Hickok marker. Forced to sell. Kielhorn Radio and TV, R. 1, Box 12, Williamston, Mich.

FOR SALE — Heathkit battery eliminator, completely wired, perf. cond., $17.50; Heathkit sig. tracer, completely wired, with pilot light added, in exc. cond., $15, or $30 takes both. COD. Otisonde, Inc., 380 Clinton Ave., Albany 6, N. Y.

FOR SALE — Radio test equip., manuals, data books, filters, capacitors, resistors, spkrs., Xformers, AN/ARR-7 rcvr., 550 kc. to 42 mc., with separate power supply, push-pull amp., 10" spkr. Gene Kuykendall, 4210 Elmwood Ct., Riverside, Calif.

WANTED — Precision tube tester of series 912-914-915-920-954. Must be in exc. cond. State price and cond. Edgar E. Landon, 3991 Forest Hill Ave., Oakland 2, Calif.

SELL OR TRADE — NRI multitester complete with AC power supply and factory cabinet, $12.50 cash or trade for late model radio tubes. Woodrow McHargue, Princeton, Mo.

FOR SALE — UTC Linear trans: LS-33 $12; LS-57 $10; LS-60A $18; LS-63 $10; LS-40 $12; Jensen professional trans. T-201 $8; Regency UHF converter, model RC-600, $25. Want pair of 300B triode tubes. E. Wolanin, 7 Eaton St., Nashua, N. H.

WANTED — Hickok 288X generator, will sell or trade Eico 315 deluxe; S-72 Hallicrafters; Kilowatt deluxe ham rig; 100 w. portable, deluxe 3-band mobile rig; 5516, 4-125A, 4D32, HK57, 2E26 tubes. Don M. Lidenton, 701 Poplar St., Poplar Bluff, Mo.

TRADE — Jackson 660 dynamic analyzer for Winchester 70 swift or 70 action. Also want 7 x 35 binoculars or Zeiss Ikonta B. Will pay difference. Harry J. Ferris, 5604 Nottingham, St. Louis 9, Mo.

WANTED — Radio Craftsman TV tuner chassis, model RC-100A, regardless of condition. Val Watral, 16 Randal Dr., Bethpage, N. Y.

FOR SALE — Admiral record changer, in wood cabinet, 13½ x 16½ x 9, plays 10" and 12" records. Howard DeLozier, 140 Fishback, Ft. Collins, Colo.

FOR SALE — 12-tube Breting receiver, with crystal, and remote spkr., and cable. Good cond., make offer, FOB. W. S. Healey, 1020 Wotan Dr., Encinitas, Calif.

SALE OR SWAP — 430 QST's, in good cond., make reasonable offer. C. D. Ferguson, 258 Home Ave., Graham, N. C.

WANTED — Surplus receiver BC-1068A, or BC-1161A, or Hallicrafter S-37. F. H. Drake, 824 No. Main St., Marion, Ohio.

FOR SALE — Power supply, choke input two-section filters, 530 v. DC at 200 MA, 6, 5, and 12 v. AC, 150 and 300 v. DC reg., input cond. can be added for 750 v. DC output, $35 postpaid. Anderson 2461 Elberon Ave., Cincinnati 4, Ohio.

FOR SALE — Admiral 1954 table model TV cabinet for 21" screen. Chassis No. 19F1B, l. n., $15. W. Liskiewicz, 93½ East 7th St., New York 9, N. Y.

FOR SALE — Radio tubes, 813 $10; 807, 866, 6L6, $1 ,each; 0-150 v. AC meter $3; power transformer, 85 MA, 550 v. at CT, $5. Justin Walker, 1000 College, Canton, Mo.

FOR SALE — E-200C sig. gen., l. n., $45; Eico 214 VTVM 7½" meter, factory calibrated, l. n., $35. Both $75 cash. R. P. McClintock, 4325 Wyoming St., Kansas City 11, Mo.

FOR SALE — Two 4½" Simpson 0-1 MA meters, and Elec. Inst. A-100 sig. gen., l. n., reasonable. George Coutts, 14 Surrey Rd., Massapequa, N. Y.

FOR SALE — Surplus school training material, used but not abused; Pict-O-Graph wireless phono osc., kit model PH-20 with T-17B mike, $6.50; radio kits (Arkay) model S-5, five tube super-het, $9.50. Jules A. d'Hemecourt, 152 Drolla Park, New Orleans 23, La.

FOR SALE — RCA 3" scope, model 155A, exc. cond., untampered, $20. J. Cozzo, 1080 68th St., Brooklyn 19, N. Y.

FOR SALE — Model 710 coastwise (Ferret) audio osc., exc. cond., $40; model 203 Electronic Laboratories, 110 v. DC to 110 v. AC, make offer. Suburban Radio Center, 203 Oak St., Harahan, La.

WANTED — Used receiver, preferably like new National NC-173, NC-183 or similar type, unmodified from mfr's. specifications. R. E. Friedley, 41 Audubon Rd., Wellesley 81, Mass.

WANTED — AC generators, 60 cy., 110 or 110-220 v. Give nameplate reading, wattage or KVA, cond., price. Broadway Radio, 694 North Broadway, East Providence, R. I.

FOR SALE — Stadium and fairground PA equipment: eight 50-w. trumpets with 50-w. Xfmrs; two 100-w. Clarion amps, asst. of trumpet racks for 3 to 6" poles, spkr., and mike cables. Denny Peterson, Box 1376, Great Falls. Mont.

SWAP — Kodak "35" with range finder, A-1 cond., in leather case, for tape recorder. C. B. Berg, 615 E. Benton Ave., Naperville, Ill.

WANTED — Book, "Electrical Vibration Instruments" by A. E. Kennelly. Jerry Sabin, 6022 Sage Dr., Orlando, Fla.

FOR SALE — Hickok 288-X sig. gen., exc., $75; Ferris 18-C microvolter, exc. $100. C. M. Sinclair, 91 Karland Drive NW, Atlanta, Ga.

WANTED — Simpson 303 VTVM; 269 or 262 VOM; Triplett model 660 Load-Chek; Hickok model 209 VTVM, and Cathode Ray tube tester adapter; Sprague T0-4 capacitor and resistor analyzer. State price and cond. W. Gaboda, 1009 No. Washtenaw Ave., Chicago 22, Ill.

FOR SALE — TV Standard Coil tuner "R" strip for channel 55, $6; Heath TV alignment gen., TS-1, instructions, wired. needs calibration, unused. Best offer over $15. Ira P. Colby, 1 Hoover St., Springfield, Vt.

WANTED — RME preselector, RME converter. Cash or trade. Bryan Edwards, 3304 - 34th St., Lubbock, Tex.

SELL OR TRADE — NRI electronic multitester (converted to 115 v. AC); RF-AC Head, leads; NRI radio (needs 2 tubes), 7 experiment manuals, all for $20, or trade for small printing press and equip. Bruno DeCola, 379 S. Broadway, Salem, Ohio.

FOR SALE OR TRADE — Magnecordette, 1. n.; Heathkits: VTVM, AC VTVM, audio wattmeter, condenser checker, electronic switch, all accurately calibrated; GI model DR, 2-speed, heavy-duty turntable; also single 78 and 33⅓ turntables. Donald Sampson, Sampson Electronics, Central City, Neb.

FOR SALE — Eico: 1040 battery eliminator, model 145 multi-signal-tracer, and 625 tube checker. All 1. n. Allan W. Seely, 48 Elm St., Danvers, Mass.

FOR SALE — Revere tape recorder, model T10, 7½ speed, with mike, radio attachment cord, two reels (one with tape), demonstration model., $175 fully guaranteed. R. Citro Radio Co., 93 Pearl St., Chelsea 50, Mass.

WANTED — Map reading stereoscope, will pay cash or exchange electronic equip. Send for list. B. Taylor, Box 1, Atlanta 1, Ga.

WANTED — Back issues of The Capacitor, 1936 thru 1949. What have you? Col. C. W. Janes, Asst. Director of Research, Sig. Corps Eng. Lab., Ft. Monmouth, N. J.

FOR SALE — $950 Philco projection TV, model 2500, needs hor. output trans. Ideal for Hi-Fi cabinet, $50 or best offer, or swap for ham equip. William Kennebeck, 34 Huddy Ave, Highlands, N. J.

FOR SALE — 8" Viking speaker in Bud CS472 cabinet, $6; Merit 3157 plate transformer; 3189 swinging choke; 3182 smoothing choke; 500/400 v. 250 MA components, all $12. N. Parker, 1240 Bedford, Detroit 30, Mich.

SELL OR TRADE — Six Alliance model BY-90 UHF converters. Prepaid anywhere in U. S., $105, or $20 ea. Ra-Tel Service, 602 Meridian St., Huntsville, Ala.

FOR SALE — $500 complete: Simpson 479 UHF-VHF sweep sig. gen., $250; Simpson 303 VTVM, $45; Precise 300 scope, $150; complete set Supreme Serv Man, $15; asst. tubes, $50; Align-o-Pak, $5; Cap. Volt Divider, $7. Fran Powers, 4217 West End Ave., Chicago 24, Ill.

WANTED — For cash, Technical Manual for EC-522 Transmitter-receiver. Norman Wehrli, Box 1247 Kilgore, Tex.

TRADE — UTC type LS-58. Want UTC type LS6L4. H. A. Rollins, 2328 Proctor St., Garland, Tex.

FOR SALE — Capacitor, 25 Mfd. 660 v. AC, C-D type KGT6250. Lists at $39.25. Make offer. T. C. Furnas, Jr., 1723 Horatio Ave., Merrick, N. Y.

WANTED — Nilson's Master course in radio communication. sections one and two. State cond., price. G. M. Ewing, Jr., 120 Wells Rd., Wethersfield 9, Conn.

TRADE — Hallicrafter S-47, AM-FM-short wave band A-B-C-, good as new, for 54 or 55 model Mattison Silver Rocket TV set in A-1 cond. Paul Baker, Mt. Vernon, Ky.

WANTED — Square wave gen., Heath or Eico, or what have you? Will pay cash. Stanley Wellenc, 256 - 12th Ave., North Tonawanda, N. Y.

FOR SALE — Radio Engineers Handbook, Radio Manual, Broadcast Operators Handbook, Radio Designers Handbook, Radio Physics Course, Practical Radio Communications, Principles and Practices of Radio Servicing and ICS math course — 32 books, $25 plus shipping. Alvin Lanford, 129 Canterbury Road, Spartanburg, S. C.

FOR SALE — 450 w. 40 meter CW transmitter, four deck rack, high and low voltage supplies, ARC 5 exciter, 812 final, metered, tube keyer, antenna relay, $100. Philadelphia area or plus shipping charges. R. B. Fairchild, 27 School House Lane, Broomall, Pa.

FOR SALE — 1953 genuine Buick auto radios: 6 v. push-button for Special, 12 v. "Signal Seeking" for Roadmaster, etc. Radio and Communications Service Co., 451 North Main St., Akron 10, Ohio.

TRADE — Seeburg juke box amp. with 2 speakers; Zenith portable model 6B03; UTC model A-17 and HA-136 Xformers; Weston model 695 meter, for any make tape recorder in good working cond. Jack Cazes, 614 Junius St., Brooklyn 12, N. Y.

SELL OR TRADE — BC-348-0 with 10-11 meter, CML converter, and 110 v. AC power supply, "S" meter, converted as per QST. Best cash offer or swap for AC-DC battery, portable covering 200-400 kc., SW and BC. O. C. Vidden, Fertile, Minn.

FOR SALE — Pentron 9T3C tape recorder, $95; SCR-522 2-meter Xmitter and rcvr. with power, $75; 15" TV set, 630 chassis, $35. M. Schwartz, 166 - 36 24th Road, Flushing, L. I., N. Y.

FOR SALE — Heavy-duty Prop Pitch motor, $14; RCA Radiola-33 model AR-784 and 100A speaker; Thordarson Xformers with 220 v. AC Pri.; Kenyon T-521 choke. Make offer. Harry E. Wood, 451 Manor Rd., Hatboro, Pa.

FOR SALE — Like new 21" custom-built Regal TV with 21" GE aluminized tube, 12" speaker, Cascode tuner, 31 tubes, never used. Make offer. Alfred M. Alexander, 159 Putnam St., New Haven, Conn.

SWAP OR SELL — Simpson 390 appliance tester; DeVry 25 w. amp., Isolation transformer; GE ⅓ hp. motor; Riders Vols. 6, 8-13. S. W. Kovacs, 417 Vannest Ave., Trenton, N. J.

WANTED — UCH-11; UBF-11; UCL-11; UY-11 tubes for German Tefag Super 5A radio, 220 v. Cash or swap. Arjay Radio Service, 1929 South Spring St., Springfield, Ill.

FOR SALE — Eico products: 221 VTVM with RF and HV probes; 320 sig. gen., 360 sweep gen., factory wired. All calibrated, with test leads; very little used, $75, local preferred. K. Gambichler, 3201 Hull Ave., Bronx 67, N. Y.

SELL OR SWAP — 2 RCA 803 tubes, never used, guaranteed. M. Katz, 147 - 11 76th Ave., Flushing 67, N. Y.

WANTED — Precision tube tester 10-12 series and Precision sig. gen., E-200-C. State condition and price. H. Wiegand, 60 South 3rd Ave., Mt. Vernon, N. Y.

FOR SALE — Precision E-200-C sig. gen.; Heathkit T-3 sig. tracer. Both instruments in A-1 cond., complete with manuals, test leads. Butler C. Clave, Petroskey, Mich.

FOR SALE — Master Mobile model 114 2-meter mobile coaxial antenna, $6 FOB. A. L. Moore, Box 5661, Memphis 4, Tenn.

FOR SALE — Collins 310B exciter, 1. n., $300; unused Precision E-200-C AM sig. gen., $50; 5-amp Variac $9; Eico VTVM $15; Silver Wavemeter, $8; RCA Image Orthicon, $7. George Kravitz, 7919 20th Ave., Brooklyn 14, N. Y.

WANTED — Schematic diagram for BC-1206-B rcvr., must include complete physical and electrical specifications. Thomas J. Manning, Jr., 54 Jackson Rd., W. Medford 56, Mass.

WANTED — One or two tape recorders, l. n. Sell or trade KW power supply parts, tubes, 61' Vesto tower, Gordon rotary beam for 20 meters, rotator, control cable, pair BC coils for HRO-7. Macy, 377 Winton, Louisville, Ky.

WANTED — Technical maintenance manual for AN/APN-4 Loran indicator-rcvr. system. Must be complete and in good cond. State price. Roy Carling, R. 1, Howard City, Mich.

FOR SALE — Industrial 75A booster, complete with tubes, $6; Hickok 600A tube tester, $150. Mimna, 271 No. 6th St., Newark 7, N. J.

SELL OR TRADE — Wilcox-Gay 2-speed tape recorder in good cond., $75. Newton Center Radio Shop, 759 Beacon St., Newton Centre 59, Mass.

FOR SALE — 7030 Philco sig. tracer; 7170 Philco sig. gen.; 645 Jackson VTVM; 140 Sylvania tube tester; all for $100 cash. Paul A. Stoudt, Box 752, Beresford, S. D.

WANTED — Smith typewriter, tape recorder, ant. rotator, enlarger, Eico or Heath late model scope. Harold F. Cushing, 16 Preston Dr., Manchester, Conn.

FOR SALE — PE-103 dynamotor; hearing aid; dictating machine; bulk spool recording wire; misc. ham gear. Want tube tester. Dick Lackner, 2029 Bradley Pl., Chicago, Ill.

FOR SALE — Field Strength meter, model A-460 by Approved Electronic Instruments., A-1 cond. Soundcraft Products Co., 9 Kelley Sq., Worchester 4, Mass.

FOR SALE — PE-103-A Dynamotor, complete with cables, never used, $15. Fread Fleck, 5853 No. Central Ave., Chicago 30, Ill.

FOR SALE — Tape transport mechanism, Ultra Audio model 90, dual track Shure head, dual speed, 110 v. spare unit, never used. With instructions and tape, $29.75. Ron Brokloff, 188 Blaine St., Johnstown, Pa.

SELL OR TRADE — Precision E-200 sig. gen., Electronics Design 100 VTVOM, never used; Simpson VOM 5 m. per v.; Sprague Tel-Ohmike 16. Want Superior Cine Printer 8-16 mm., 16 mm. projector, Hi-power binoculars. Robert Cooke, 88-42 85th St., Woodhaven 21, L. I., N. Y.

FOR SALE — HQ-129X, recently overhauled and in exc. cond., $100. L. O. Adams, RD 2, Millerton, Pa.

WANTED — "TDQ" VHF radio transmitter. Amateur Radio Station, Harry Williams, Pleasant Hill, Mo.

SELL OR SWAP — ES-500A Precision scope, $125; SP-5 Precision probes, $15; Hickok 610A sweep gen., $110; Riders TV manuals 8-12, assorted tech-files, $90. Want ham rcvr., and gear. F. Garove, 722 Thayer St., Akron 10, Ohio.

FOR SALE — Heathkit SG-7 sig. gen., contains audio osc., and RF gen., in l. n. cond., instructions, $15. X-Pert Radio, 610 Cedar St., Wausau, Wis.

WANTED — Latest VTVM kit, sweep gen. kit, tube tester kit. Have tubes, amp., UHF converters, etc. Ben's Radio Sales and Service, Nash Rd., No. Tonawanda 2, N. Y.

WANTED — Detector head for Army mine detector SCR-625-C, must include coil, meter, tuning assembly, handle. Cash or swap radio parts, tubes, hearing aid battery charger. John Haynes, Doe Run, Mo.

FOR SALE — Precision E-200-C sig. gen., output cable, and manual, $50; Simpson 260 VOM, leads and manual, $27. Both like new, express COD with 24-hour inspection privilege. L. M. Carling, Howard City, Mich.

FOR SALE — Tube caddy, hardwood finish plywood construction, attractive brass hardware, 17" x 14" x 8", provides room for 140 tubes and tools, $9.95 FOB. C. W. Chastain, 228 Timber Lane, Memphis, Tenn.

FOR SALE — TV conversion kit, including new 20" rect. 20HP4 tube, 70 degree yoke, 14000 GE flyback Xformer, width coil, safety mask and shield. Cash or trade for tape recorder in working cond. Sent FOB. John O. Hehn, 18 South Jardin, Shenandoah, Pa.

SELL — Eimac VC-50-32 and 2 Jennings VC-12-20 kv. vacuum capacitors; pair 5" dia. brass type 14 trans. and repeater Bendix selsyns, $25. Art Bonte, 3138 Kingsbridge Terr., Bronx 63, N. Y.

FOR SALE — Riders 1-5 abridged, 6 thru 19, TV2, in exc. cond., parts, tubes, equip., spare meters, net value about $1,100, sacrifice for $300 cash. Albert F. Harriman, Erving, Mass.

SELL OR SWAP — Pilot FM tuner, T-601, 1. n., $17.50 in orig. carton, instruction manual; 2 Weston type 534-50 micro-amp. relays, new net $75 each. Make offer. S. Winston, 55 Chumasero Dr., San Francisco 27, Calif.

WANTED — Elmac PMR 6-A portable mobile rcvr., Leo P. Lostuvka, 1044 19th St. SE, Cedar Rapids, Iowa.

FOR SALE — Philco auto radio, model 827 in good shape, $10. Louis Mendezoff, 5810 East Pleasant Valley Rd., Cleveland 9, Ohio.

FOR SALE — Oscilloscope BC-412-B, back issues "Electrical Engineering." Local only. Nolan I. Wolk, 1411 Avenue M, Brooklyn 30, N. Y.

WANTED — VTVM, dual-track tape recorder head, old QST's, 40 meter. Loren K. Zoll, 417 East Townley, Bluffton, Ind.

WANTED — Philco rcvr., with mystery control Xmitter remote tuning, rcvr. need not be operative. L. Albert Webb, 4 Bullard Ave., Holyoke, Mass.

WANTED — Hickok tube tester model DM-532 and Hickok scope, model 195 for cash. Sell or trade Philco Jr. scope, model 7019. Thornhill Radio and TV, Hoschton, Ga.

SELL OR TRADE — 5 vol. Coyne Applied Radio, Weston Master II exposure meter, Rider vol. 12, Photofacts vol. 1, 2, 4, Omnigraph, Rider C.R. Encyl., several Weston 506 0-5 v. DC. L. Putnam, Woodward, Iowa.

SELL OR TRADE — Hallicrafters S-59, FM-AM- phono chassis with 12" Jensen spkr. in A-1 cond.; GE capacitance-resistance bridge, model YCW-1, 1. n. Want Precision E-200-C in A-1 cond., or good VTVM. Robert Peters, Lincoln Way, W., Ext., Massillon, Ohio.

FOR SALE — $75 buys 28 w. push-to-talk mobile station, Stancor (factory wired) Xmitter, tri-band converter, clipper, control box, cables, diagrams, etc. AC supply extra. Now in operation. Charles Warrington, 12 Shattuck St., Nashua, N. H.

FOR SALE — Pentron tape recorder 9T3C in orig. carton, $95; Presto K-8 disc recorder and play-back, exc. cond., $145; Super-Pro rcvr., BC-779-B in exc. cond., with power supply and cable, $175. A. C. Livingstone, 12-01 Ellis Ave., Fair Lawn, N. J.

WANTED — ART-13 driver and modulation transformer. Swap pair each new boxed 829B and 6146 tubes. T. C. Fratia, Paxton, Ill.

SELL OR TRADE — Carter dynamotor 350 v. at 150 mils., 6 v. primary; Argus C3 camera with case and flash, exc. cond. Want HO gage engine, Reflex camera 2¼ x 2¼ Agroflex, etc. Clyde L. Keeler, 66 Franklin St., Port Jervis, N. Y.

TRADE — Speco sig. tracer with probe for used radio service course. John N. Conroy, 2608 No. 11th St., Philadelphia, Pa.

SELL OR SWAP — Riders radio manuals, 10 to 19, seldom used, $96 or good camera. Luther Hoffman, 678 Princeton St., Palmerton, Pa.

SELL — Back issues from 1944; Radio News, Radio Craft, Radio & Television News, Radio Electronics, Radio Maintenance, QST, CQ, ARRL Handbooks. Send stamped envelope for list. Robert Kopecki, 2910 West 3rd St., Chester, Pa.

FOR SALE — Lafayette intercom $12; new 0-10 MA. Triplett 2" square illuminated meters $3.50 each; code oscillator $3.50; power supply, 600 v. DC, Brute Force filter, 150 MA., 6.3 v. filament supply with 5U4G rectifier, $10; Dynamic mike with stand, cable and connector, $5. Wzasi, 144 - 34 72nd Dr., Flushing 67, L. I., N. Y.

WANTED — 60-75 w. amp., mobile system, 2 trumpet speakers, phono, mike, etc. Give best price. Fred Simonian, 96 Blossom St., Lynn, Mass.

WANTED URGENTLY — Radio head for 1946 Chevy to fit Motorola "65." Also want solonoid for press camera, etc. Bill Hagara, Box 224, Slickville, Pa.

FOR SALE — RCP model 315 tube tester, modernized, in good cond.; Studebaker custom Motorola model 8A, 1. n., both for $40 or what have you. Prefer local. Ray's Radio & TV Repair, 2808 South 112th St., West Allis 14, Wis.

FOR SALE — Rider manuals, 12 thru 18, and NRI vol. I. Make offer for one or all. Edmund Griglak, 1750 Ashton Ave., Sharpsville, Pa.

TRADE — HO electric train or Lionel outfit for good 5" oscilloscope, late model in good cond. Arthur Lillian, 422 1st Avenue North, Seattle 9, Wash.

FOR SALE — Like new Philco model M8104 TV Field Strength meter, $75. Wells Brady, 127 South State, Rigby, Idaho.

SWAP — Complete DeForest radio course for complete commercial art course. Harry Rainson, 13 - 17 W. 128th St., New York City 27, N. Y.

SELL OR SWAP — Eico sig. tracer, $15; Mossberg 20 guage shotgun for VTVM. Consiglio TV Service, 4615 Furman Ave., Bronx 70, N. Y.

FOR SALE — Type 83 400 v. Full-wave power supply, $25; Supreme 542 VOM with probes, $15. Both in perf. con., FOB. H. Gehring, 1200 Stockwell Blvd., El Paso, Tex.

FOR SALE — Victor 16 mm. sound projector, model 25, perf. mechanical cond., in two cases, with 15" spkr., $100 FOB. Want good small FM tuner. Paul E. Wang, 2249 East 28th St., Brooklyn 29, N. Y.

FOR SALE — VT-121 12" Motorola TV, l. n. cond., with all tubes and cabinet, $35; Electrovoice model 3000 booster, l. n., with four 6J6 tubes, $10. Mike Peterhans, Pond Farm, Guerneville, Cal.

FOR SALE — Hi-Fi equip.; 14 w. Newcomb amp.; 15" Jensen coaxial speaker in bass reflex cabinet; Garrard RC 80 changer; record cabinet. Frank Bou 47 Oswego Ave., Audubon, N. J.

WANTED — Will pay cash for good marine receiver. State price, description. Joseph Malak, Center and Sperry Rd., Chesterland, Ohio.

FOR SALE — Hallicrafter all wave SX-62A receiver in very good cond., $180. Local only. Anthony Indingaro, 47 Monmouth St., East Boston, Mass.

WANTED — Policealarm PR8, PR9, PR31; Hallicrafters S-81 or 82 FM receivers, any cond., cheap for cash or will trade tools, radio gear. C. Stout, 2241 East Broadway, Muskegon, Mich.

FOR SALE — Complete radio shop equip. and parts, four-room apartment in rear, bath and steam heat. Corrado's Radio Service, 74 William St., Newburgh, N. Y.

SELL OR SWAP — Stamp collection, for small screen TV, tape recorder, FM radio, or what ?? Bill Brasie, 420 Adams, Owosso, Mich.

SELL OR TRADE — BC-455, BC-458, 813, 814, tubes, PE-103 without base, etc. Want BC-603, BC-683, APS-13, BC-645, BC-788 and scope unit (altimeter) 20-174 mc. equip., particularly Link FM radio equip. J. B. Jones, 1222 Cruiser Ave., Louisville 5, Ky.

SELL OR SWAP — Riders manuals, vols. 1, 2, 5, $12; Supreme sig. gen., model 581, A-1 cond., $20; Audels Refrigerator & Air Conditioning Guide, $3; Relay Hand Book, $2, or what have you in trade. Kauer Radio Service, 142 Mohr Ave., Buffalo 12, N. Y.

FOR SALE — National Co. Hi-Fi 10 w. amp.; Webster 55 record changer; AM tuner T.R.F. 4 tuned stages; 12" Stromberg spkr., 25 w. in cabinet. Best cash for complete set-up. Roger Shaw, Box 802, New Bedford, Mass.

FOR SALE — Feiler TS-3A Stethoscope, factory assembled, tested, never used, with instruction manual, $25. Lawrence Olson, 5225 West 147th St., Box 230, Tinley Park, Ill.

JOB WANTED — Experienced radio - TV tech and electrician, over 20 years exp., age 42, married. Prefer work on broadcast transmitters or mobile operation, and in Kansas City, Kan., or Missouri. Would consider TV shop work. Carl V. Hill, 409 East Osage St., Paola, Kan.

MUST SELL — Complete radio stock: 20 coin radios, transformers, resistors, condensers, tubes, Xmitters, receivers, lots of equip., over $3,000 net price. Will sell lot for $2,000. Noyes Radio Co., Estes Park, Colo.

FOR SALE — T-9004 Thor Xformer Tru-Fidelity plate to grids, split windings, perf. cond., $4; and Millen 10035 multi-scale dial with knob, minus paper scale holes added for vol. and tone, $3. Augustine Mayer, 561 South Sandusky St., Tiffen, Ohio.

WANTED — Precision or other standard make tube tester to test all tubes. Theodore Lohr, 140 - 28 247th St., Rosedale, L. I. 22, N. Y.

WANTED — RCP 88T3A Servishop or 808A model 730 Signaliner. Bob Robinson, 621 Charlotte St., Utica 2, N. Y.

FOR SALE — Hallicrafters S-53 receiver, $20; Hi impedance featherweight headset, $3. John R. Willis, Passaic Avenue, Caldwell, N. J.

TRADE — PA systems; Bud amp.; GI disc recorder; Wilcox-Gay Recordette. Grey Mather, 722 Charlotte St., Utica 2, N. Y.

FOR SALE — Heath TS-2 sweep gen., with probes, instruction manual, $35; Heath TC-1 tube tester, with CRT test adapter and instruction manual, $25. Both are assembled and very good cond. Ship COD, insured. R. N. LaPlante, 1714 10th Ave., Green Bay, Wis.

SWAP — 2 UHF Motorola Blonde convertors, model TC-101 for novice Xmitting equip. Clarence I. Cook, 124 Chestnut St., Medina, N. Y.

TRADE — NRI communications course with experiment booklets, for NRI radio and TV servicing course with experiment booklets. C. K. Eser, 2221 East Lombard St., Baltimore 31, Md.

FOR SALE — TV scope, cost new $199.95, one yr. old, factory reconditioned, make reasonable offer. E. A. Stewart, RR 3, c-o Community Trailor Co., Lucasville, Ohio.

TRADE — Manuals for SCR-536B, SCR-281D, BC-312M and 342M, SCR-694C, and SCR-284A. What have you? Theodore Nadeje, 5101-AA 39th Ave., Sunnyside 4, N. Y.

FOR SALE — Heathkit FM tuner, l. n., reasonable or trade for Hi-Fi equip. Wharfdale speakers preferred. Erik Avis, 448 South 10th St., San Jose, Calif.

WANTED — Tuner for RCA TV set, model 9-T246. Will trade TV test equip., for cameras and darkroom equip. Norman TV Service, 112 Douglas Ave., Rockwood, Tenn.

WANTED — Tapes for TG-10 and TG-34A Keyers by sets or individual tapes. E. L. Neill, Box 33, Cleburne, Tex.

SWAP — GE ammeter with Mirror Scale, range 0-125-250-500 amps., for Triplett model 630A or 630 VOM, must be A-1 cond. Harold Buckley, 1545 Hoefgen St., Indianapolis 3, Ind.

FOR SALE — Eico 20,000 ohms per volt Multimeter, exc. cond.; 3 light stands for indoor photography. S. Mossey, 1510 Ocean Pkwy., Brooklyn 30, N. Y.

SWAP — Quantity of Xmitter equip, for pickup truck. Send for listing. Local preferred. Ed Baclawski, Pulaski Hwy., Ansonia, Conn.

FOR SALE — RMS TV preamp., uses 6AK5 tube, needs new tube, $5; Coyne's Applied Practical Radio, 5 vols, l. n., about '49 or '50 edition, $5 FOB. J. L. Smith, 3508 Turkeyfoot Rd., Akron 19, Ohio.

SWAP — 6-tube 3-way Truetone portable radio, stock D3840, needs 1R5 tube, for tube tester, quick check capacity tester or what have you? Lyle C. Newell, 3287 70th Avenue North, St. Petersburg, Fla.

TRADE OR SELL — BC-453, Q5-er, two BC-222 Walkie-Talkies, BC-458, BC-375 parts, very good cond. Want variable audio osc., 5" scope, SX-28. Prefer to trade. Donald Evrard, 914 11th St., Tell City, Ind.

FOR SALE — Supreme audolyzer, model 562 with probes and instruction manual, l. n., $75; also odd Sams folders, $1 each. Charles Huddlestun, 826 Chester Ave., East Liverpool, Ohio.

FOR SALE — Profitable radio service business, equip., stock, and house on 2½ acres. Retiring. John Erdman, Webster, S. D.

FOR SALE — Nearly new model 322 Eico sig. gen., $17.50; little used Precision series 85 Multitester with new batteries, $25. Both in orig. box with instructions. Send cash and I pay postage. Ewell Churchill, Cord, Ark.

FOR SALE — T-601 FM Pilotuner, $12 cash or money order. Eugene Cheney, Nora Springs, Iowa.

TRADE — Simpson model 29 heavy duty dual movement DC milammeter 4½" scale, 150-0-150 MA. What have you? Joseph Cooper, 46 Rockwell Ave., Long Branch, N. J.

FOR SALE — Heath TS-2 TV alignment gen., perf. working order, used only a few times, $30. L. T. Anstine, 715 Howard Rd., Baltimore 8, Md.

WANTED — Sweep gen., vibrator tester, Eico sig. gen., 315. Will pay cash or trade test gear, tubes or parts. P. Ferrina, 4309 Kansas Ave. NW, Washington 11, D. C.

SELL OR SWAP — Ameco Code course, 5 records; code oscillator and key, unused and enclosed in traveling case, for tube tester. William M. Collings, 5 Johnson Rd., Arlington, Mass.

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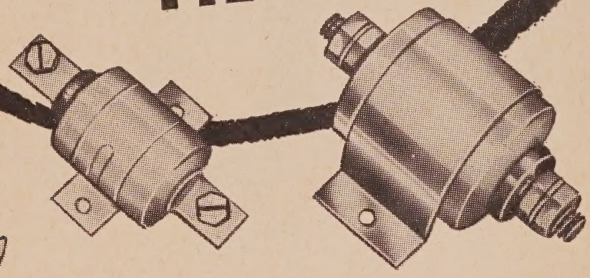

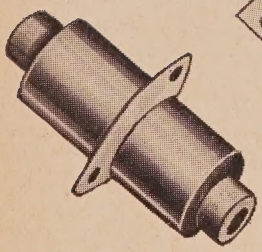

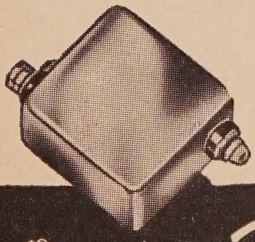

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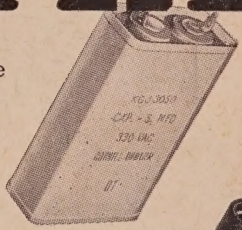

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